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ABSTRACT

Oral language techniques, individualized elementary mathematics, and outdoor education were used as the subject matter for this inservice program for training of teachers of migrant children. The cral language program stressed the importance of the sound sequence of development in learning the English language: listening, speaking, reading, and writing. (Pattern drills used in the program are included.) The mathematic and outdoor education sections of the workshop stressed the need for positive teacher attitudes and emphasized that the teacher and child can be learning partners. Techniques are provided for better evaluation of student progress, and activities are given for involving the student in the learning process. (LS)

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Partners in Learning...

Teachers & Migrant Children

Glen Helen Workshop: April 30–May 2, 1970

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Foreword

Federal funding to attack the educational problems of migrant children is available under special provisions of Title I of the Elementary and Secondary Education Act. The establishment of this funding was recognition of the importance of educational programs designed to improve the opportunities of migrant children. These children must be prepared to meet inevitable changes brought about in part by increased mechanization in the harvesting of crops.

The challenge for educators is providing today's migrant children with skills needed in tomorrow's world. The task is not an easy one. The mobility of the children and language deficiencies are two of the most pressing challenges. Although migrant children spend only part of their school year in Ohio, that time must be planned to provide them with an educational program that best meets their needs.

Inservice training is one method whereby teachers can learn to understand migrant children, their language problems, and related educational needs. At a workshop conducted April 30 through May 2 at the Glen Helen Outdoor Education Center in Yellow Springs oral language techniques, individualized mathematics, and outdoor education were considered as problem-solving routes. This publication contains adapted versions of workshop presentations.

As Director of the Division of Federal Assistance Ohio Department of Education, I would like to acknowledge and extend my appreciation to the seminar participants, to the Glen Helen staff, and especially to Miss Rosie Barajas, Dr. Lola May, and Mr. Harry H. Feldman whose articles appear here.

For making the seminar arrangements and for printing this report, we are indebted to the School Management institute.

R. A. Horn

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Oral Language Techniques

Rosie Barajas

The bilingual Mexican-American child represents one of the most vexing educational problems in Texas and other states in the Southwest. He represents problems that are only superficially similar to those posed by bilingual school children in the immigration centers of the United States – European and Cuban immigrants, for example. He is unlike the European in that generally his ancestors lived in the area long before it was settled by the English speaking society; he is unlike the European in that he has generally resisted total assimilation but, like the Puerto Rican, maintains a strong traditional pride in his cultural and linguistic heritage, however meager his knowledge of them might be. He is unlike the Cuban immigrants in that his parents usually are unskilled or semi-skilled laborers and farmers, with limited education and low socio-economic status.[1]

[1]*Baker, Marie Esman. "One Method for Producing Automatic Control of English Phonology and Structure," TESOL (Teaching English to Speakers of Other Languages) Quarterly, Vol. 2, p. 268.*

Recognize the Language Problems of Migrant Children

The Mexican-American child, particularly one whose family follows the migrant stream, often walks into the classroom speaking little or no English. In many schools, such a Spanish-speaking child is expected to plunge into schoolwork without basic English language skills. What little English he may know usually consists of words and phrases. Seldom is he able to give complete or correct sentence utterances. The utterances will usually be distorted because, in the process of conveying the thought he wishes to express, he unconsciously reverts to the mechanics of Spanish—or, in other words, to a dependence on native language habits.

Not until the learner of the new language has achieved automatic mastery of basic patterns will he be able to speak the language effectively. Many times a migrant child is

expected to learn English just by reading or writing words, sentences, or paragraphs. He doesn't know what the words mean; he may never have even heard them orally. Nevertheless, the child is expected to take rules given to him by a teacher or by a textbook and apply them on his own. The result is often an inability to use English and, possibly, development of an adverse attitude toward language learning.

Provide Opportunities for Successful Learning of English

Oral language is the key to success in learning a language. For Spanish-speaking migrant children the use of pattern drill practice, until the basic English patterns become permanent and fixed within the learner, can result in an unconscious and habitual realization of the structure of the English language. What is needed is practice that will help the learner focus his attention away from the linguistic problem and focus only on the content of what he is going to say. This calls for constant practice of the language. Without practice, little language learning will occur.

The learners of a new language need to learn to hear and speak the new language to become aware of the basic patterns before advancing to reading and writing. The sound sequence of development in learning a language is . . .

listening,
speaking,
reading,
writing.

The oral language technique is based on the concept that the new language should be impressed first through listening. Learners of the new language are taught to hear sounds that do not exist in their native tongue by imitating and by repeating. Imitation and repetition are very effective in helping children establish new English language habits.

Teaching English as a Second Language

- Teach listening and speaking first, reading and writing later.
- Remember that speech is not invented by the learner, it is imitated.
- Have learners practice basic conversational sentences through oral pattern practice.
- Introduce patterns gradually, building from the easier ones to harder ones.
- Teach the sound system by demonstration, imitation, contrast, and practice.
- Control the vocabulary as learners are mastering the sound system and grammatical patterns.
- Teach practical and useful vocabulary.
- *Present vocabulary in sentences,* not in isolation.
- Remember that translation is not a substitute for language practice.
- Teach the language as it is, not as you think it ought to be.
- Teach grammar by practice, not by explanation.
- Teach intonation and stress by example rather than by theory.
- Use the native language for explanation only when necessary.

Based on principles outlined by Robert Lado in Language Teaching. *New York: McGraw Hill, Inc., 1964.*

Using Pattern Drills

- Teach basic sentences containing useful vocabulary.
- Present drill sentences without reading them so that you can look at the pupils.
- Have the learners concentrate on listening.
- Be sure the learners understand the sentences and the meaning of words.
- Repeat the model sentence as often as necessary.
- Speak loudly and clearly with natural intonation.
- Do the first pattern change by example rather than by explanation.
- Say, or mouth, learner responses to help them establish the rhythm and stress.
- Use hand motions for drill directions rather than words.
- Conduct drills at a brisk pace to avoid draggy or sing-songy responses.
- Move around the classroom in order to hear individual learners.
- Proceed from full group response, to small group response, to individual response.
- Call only on individuals who have learned the basic patterns.
- Use visual aids to facilitate understanding.
- Avoid translations as much as possible.
- Vary drills to prevent boredom.
- *Have fun with drills!*

Adapted from Parts of Spoken English *class conducted by Allen T. Apodaca, Education Coordinator, Washington State Migrant Education Program.*

Use Pattern Drills for Practice in Speaking English

Pattern drills can be used to provide the practice in speaking the language that children need to develop unconscious habits of sentence structure and correct grammatical usage. Oral structured drill involves the repetition of a language pattern with small and consistent changes at each repetition. The changes consist of a conscious substitution of some component other than the chief component being taught so that the pupils' attention is drawn away from it while the sentence pattern is being repeated. The teacher presents a model and the pupils repeat it. This process is continued until complete mastery of the model with correct rhythm and intonation is attained. *Structured drills should always be done orally.*

Seven types of pattern drills are described below. Any classroom teacher can readily learn to use these oral language techniques to help children master basic English language patterns.

1. **Repetition Drills.** Repetition drills constitute the first and easiest step. The models for repetition should always be short and should be repeated frequently.

The learners are to listen carefully to the model sentence and repeat it, imitating the teacher's pronunciation and intonation. Repetition should be continued until complete mastery is achieved. Examples follow.

Teacher: The pencil is yellow.
Learners: The pencil is yellow.
Teacher: The pencil is new.
Learners: The pencil is new.

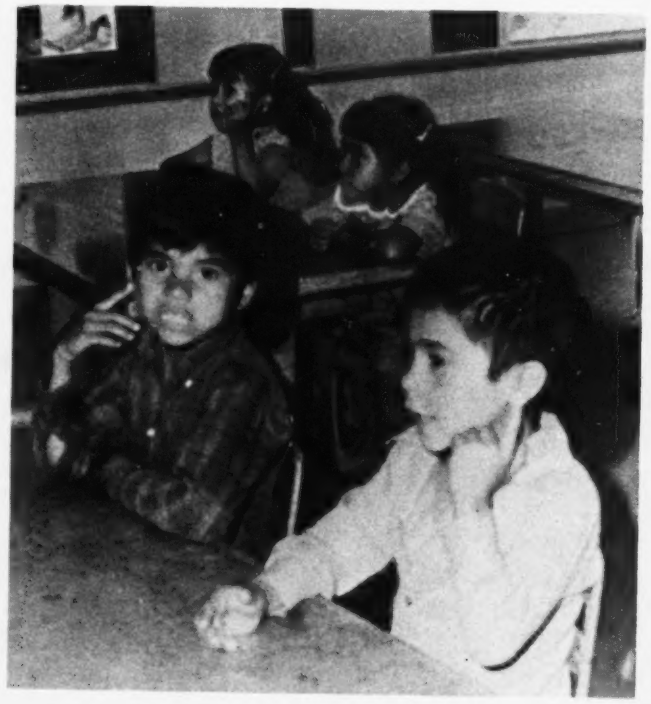
Teacher: I will go.
Learners: I will go.
Teacher: I may go.
Learners: I may go.

2. **Substitution Drills.** Pattern drills involving substitution are of three types: simple substitution, variable position substitution, and double substitution.

For simple substitution drills the teacher should present a model sentence and have it repeated by the learners. Then show, by example, how one word can be replaced by another without changing the basic sentence pattern. To continue the drill, provide a cue and the learners respond by substituting the cue in the basic sentence pattern.

Teacher: The pencil is yellow. Red.
Learners: The pencil is red.
Teacher: New.
Learners: The pencil is new.

Teacher: I think that I will go. Hope.
Learners: I hope that I will go.
Teacher: Doubt.
Learners: I doubt that I will go.



This is my ear.

Simple substitution in variable positions should be the next step. Rather than substituting words in a fixed position, change words in varying positions of the sentence. One at a time, the subject may be changed, then the verb, then the object, and then the modifier. If further practice is needed the verb may be changed again, then a word in another position, and so on.

Teacher: I should go to school early. We.
Learners: We should go to school early.
Teacher: Could.
Learners: We could go to school early.
Teacher: Town.
Learners: We could go to town early.
Teacher: Tonight.
Learners: We could go to town tonight.

Double substitution drills should be introduced next. For these pattern drills two cues are given and substituted in the pattern. For variety, cues may be given for alternating words instead of for the same one throughout the drill.

Teacher: Juan saw the train. Maria. Ship.
Learners: Maria saw the ship.

Teacher: Manuel played football. Susana. Volleyball.
Learners: Susana played volleyball.

3. Transformation Drills. For transformation drills, a sentence can be transformed from positive to negative or from a statement to a question. Transformation changes may also be in tense or voice.

Teacher: It is a nice day today.
Learners: It is not a nice day today.

Teacher: It is a nice day today.
Learners: Is it a nice day today?

Teacher: It is a nice day today. Was.
Learners: It was a nice day today.

Teacher: It was a nice day.
Learners: The day was nice.

4. Conversation Drills. Conversation drills are used with individuals rather than groups. Another difference is that the learner no longer repeats the pattern. Instead he chooses what he wants to say when asked a question. With this type of drill the learners use English in a natural situation.

Teacher: Did you do your homework last night?
Learner: Yes, I did my homework last night.
or
No, I didn't.
Teacher: Jose, did you do any homework last night?
Jose: Yes, I did arithmetic. Maria did you do any homework last night?
Maria: Yes, I studied spelling. Frank, did you . . . ?

5. Addition Drills. For addition drills the sentence is enlarged as new words are added. This helps to focus the attention away from the problem of structuring longer sentences.

Teacher: John runs.
Learners: John runs.
Teacher: Fast.
Learners: John runs fast.
Teacher: Very.
Learners: John runs very fast.
Teacher: To town.
Learners: John runs to town very fast.
Teacher: Everyday.
Learners: John runs to town very fast everyday.

This is my head.

This is my nose.

This is my hand.

6. Backward Build-Up Drills. Backward build-up drills are especially effective in practicing long sentences. Because learners have difficulty hearing the end of a long sentence, begin by practicing the end of the sentence and build up to the beginning. This technique also helps in teaching rhythm and intonation.

Teacher: At 8:00.
Learners: At 8:00.
Teacher: Tomorrow at 8:00.
Learners: Tomorrow at 8:00.
Teacher: At work tomorrow at 8:00.
Learners: At work tomorrow at 8:00.
Teacher: I will be at work tomorrow at 8:00.
Learners: I will be at work tomorrow at 8:00.

7. Integration Drills. For integration drills the teacher models two sentences or utterances. The learners respond with one integrated sentence.

Teacher: The boy was happy. The boy was singing.
Learners: The happy boy was singing.

Teacher: The dog was hungry. We fed the dog.
Learners: We fed the hungry dog.

Be Patient and Understanding

Language is a learned behavior, is habitual, and serves as a basic constituent for social interaction.

When teachers recognize the language problems of Spanish-speaking migrant children, when they provide opportunities for successful learning of English, when they use pattern drills for practice, children will learn . . .

. . . through affection, through love, through patience, through understanding, through belonging, through doing, through being.

Remember that day by day the child comes to know a little bit of what you know; to think a little bit of what you think; to understand your understanding. That which you dream and believe and are, in truth, becomes the child.[2]

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[2]*From a handbook written for the Edinburg, Texas, Independent School District.*

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Building Bridges in Elementary Mathematics

Lola J. May

Positive Teacher Attitude

People who feel mathematics is difficult – and that is most of the adult population – have usually had at least one teacher with a negative attitude toward mathematics. All successful teachers of mathematics must have a positive attitude and a positive running vocabulary. My favorite comment is *a rubber cigar to you!*

A learner's feeling of success comes mostly from the judgments of other people. Each time a pupil gives his teacher an answer, he has worked some problem – but, not necessarily the problem presented by the teacher. The teacher's responsibility is to find out what problem the child has worked and praise him for that response.

One day, for example, I was teaching in a first grade and having the children give various names for the number eight. One little girl said, "Five and one." My response was, "Fine, Suzy. What is five and one?" She responded, "Five and one is six." I then said, "Rubber cigar to you! It is true that five and one makes six. Now, see if you can find a name for eight."

What would have been the advantage of saying, "Suzy, you're wrong." When a teacher says "You're wrong," the learner turns off and feels miserable inside. Any explanation given by the teacher is lost for him. Instead of saying "You're wrong," the teacher should say, "Show me." To illustrate, if a teacher asks a child what is eight times zero and the child responds eight, the teacher can smile and say, "Show me." The child will probably respond, "Eight times zero is zero plus zero plus zero – whoops! I mean zero." Then the teacher can say, "Rubber cigar to you! You recovered your own error."

None of us went to law school and we are not lawyers or judges who should go around making judgments. Our role as a teacher, or educator, is more like that of a physician. We are to heal – as well as to teach.

Better Pupil Evaluation

All teachers should work on better methods of evaluation. We need to learn to evaluate progress, not standards set up in the market place. Where did the pupil start and where is he now are the important questions. Work should be prescribed according to the skills possessed by the learner.

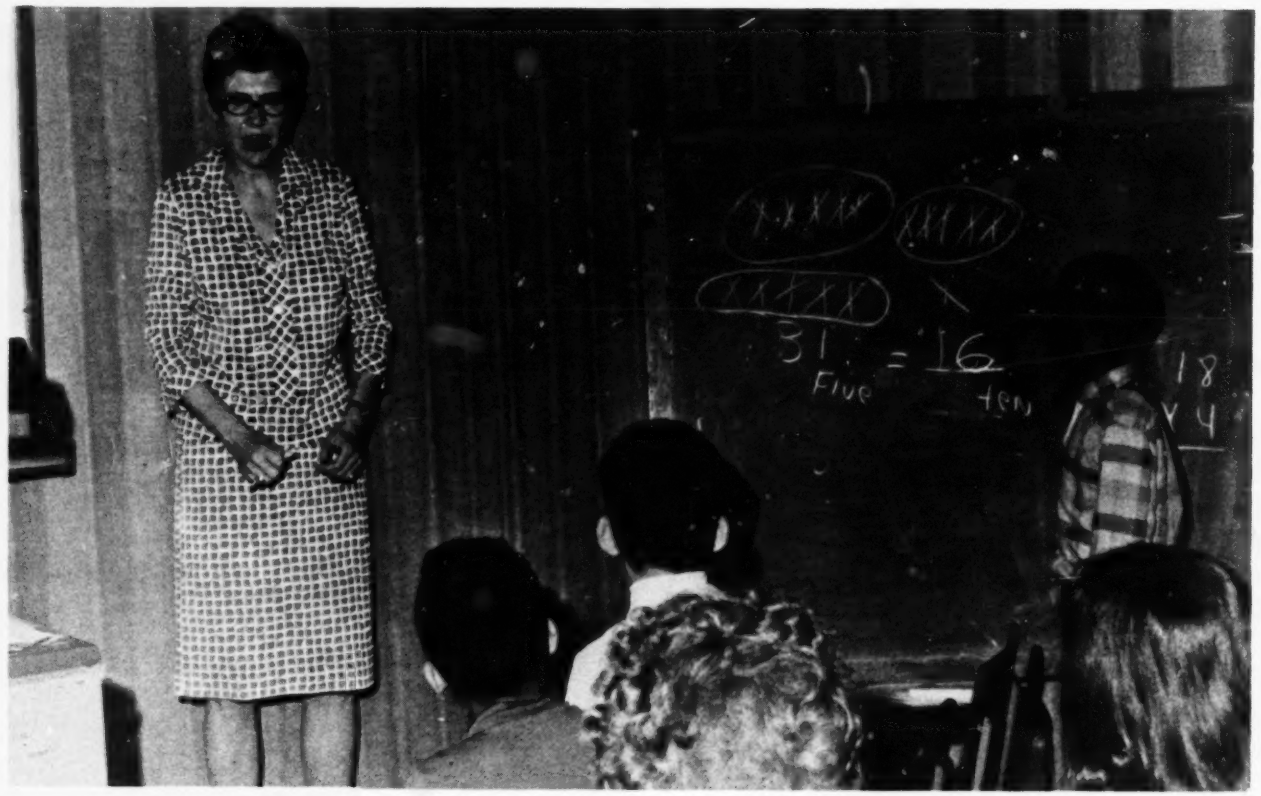
More evaluation should be done with the eyes and ears. By listening and looking one can find out a great deal about the thinking process, more than is told by little answers to little questions on a piece of paper. Five minutes alone with a child, seeing and talking about his work, is often worth one hundred minutes spent at the chalkboard demonstrating an algorithm to the whole class. The truth remains, *dialogue is an act of love.*

Pupils need to be seen and they need to know someone who has compassion. Great teachers see pupils, are willing to get involved, and have compassion. Additionally, great teachers can make decisions and they do vary content, expectations, and methods of presentation.

Non-Standardized Approaches

We need to remind ourselves that *there is no standardized fourth grader,* or any other "grader." Some fourth graders are capable of long division and capable of adding and subtracting like and unlike fractions. Others have difficulty with renaming in subtraction of whole numbers. The grade or age of the child is not what is important. What is important is where the child is in the sequence of the content of mathematics. It is far easier on the learner and on the teacher if we take the learner from where he is instead of from where we think he should be because of his chronological age.

Only a secure teacher can work with a pupil at his level and not feel that if the pupil is not at the standards set by textbooks, it means



failure on the part of the teacher. Once you are committed to the child and his welfare and forget yourself, you can take the child at his level and give him a feeling of success.

Teachers need to prepare their own pre-tests for the units presented in mathematics textbooks. Then, on the basis of the pre-test results, each pupil can be taught what he does not know about the unit.

Small-Bit Instruction

Instruction should be given in small bits so that when you build the bits up you have the whole algorithm. The teacher has to analyze all the steps and be sure the learner has activities that will teach each step.

Practice, clear and devoid of excess language or symbols, must accompany the learning steps. Praise, such as *a rubber cigar to you,* should be given as the pupil progresses along each step of the learning process.

Reasonable Assignments

Assignments should be made up of only a few problems so that the learner has the feeling he can complete them. The problems should be ones the learner has demonstrated he understands. He needs the practice, but most important he *should be successful as he practices.*

When a learner reaches an impasse – as, for instance, in subtraction – the teacher should move on to another area such as multiplication where subtraction is not a prerequisite. After the learner experiences success with multiplication, the teacher can go back and re-teach the child subtraction.

Concrete Activities

Always find ways that the learner can be involved with concrete activities while he is learning a new skill. Use the abacus for renaming, for place value, for addition, and for

subtraction. The pupil needs the experience of moving the discs to see for himself that the problems really can be worked.

When one aid fails, try another. Money usually works when all other aids fail. A child can trade one dime for ten pennies, and work out the addition and subtraction problems. Or, for some children, poker chips can make the whole idea of place value clearer than any other teaching aid.

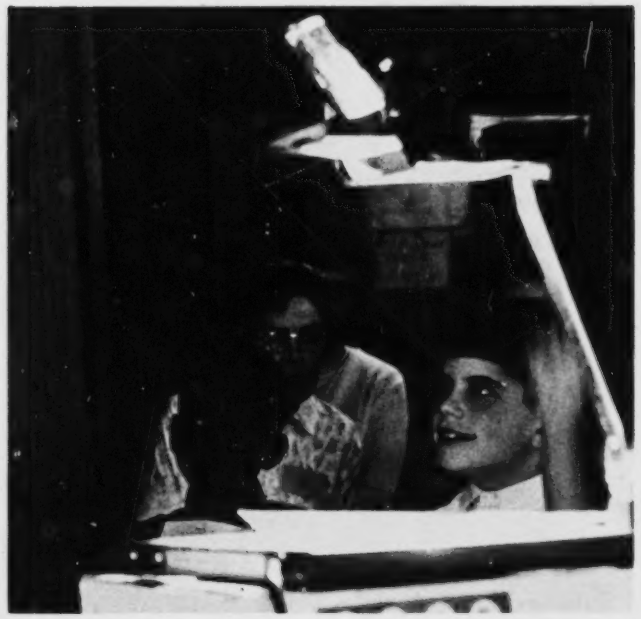
Sequential Development

A teacher needs to know the whole sequence of mathematics and then be flexible. Certain skills, such as multiplication and division, have prerequisites. A learner cannot understand multiplication as a short-cut of addition unless he understands how to add. He cannot be successful with division unless he understands subtraction and multiplication. Some skills – time, measurement, meaning of fractions, and geometry – do not have prerequisites and can be taught in various places in the mathematics program.

All society demands of most children and adults is simple computation. Once a learner can do this, then perhaps he is ready for more abstract thinking and for generalizations.

Creative Presentations

The teacher needs to be creative in the presentation of concepts. Sometimes using an overhead transparency is the best method. With a transparency you can show a problem, one part at a time, and build up to the whole algorithm. Also, with an overhead you face the children and can see whether most of them are responding to the presentation. To answer questions related to parts shown on a transparency, pupils can be taught to hold up response cards. Then, not one child is answering, but many children. The teacher can readily see who needs extra help. When working with objects, the teacher can place



a set on the overhead viewing platform so that all children can see how to manipulate the objects. They can visually compare their own work with that of the teacher.

Some lessons should be taped so that pupils can work independently. The tape can reinforce the responses and the child will know immediately whether he is right or wrong. If, when working with a taped lesson a child makes a wrong response, only the tape recorder and the child knows – *and the tape recorder will never tell!*

Games should be devised that can be used for drill and for practice. When children play with each other they are happy and they can learn a great deal. Games provide needed variety in lessons.

As another way to vary presentations, cards can be created that require working only one problem. Lessons on the cards can vary in difficulty. Answers can be provided so pupils have the satisfaction of solving the problem and of having immediate feedback.

Children should work at the chalkboard where the teacher can help many pupils at one time. Furthermore, one child can offer help to another child standing beside him. Student power can be one of the best methods of teaching.

A creative teacher is made by the creative teacher next door. Share ideas and don't be afraid to try new approaches. You have everything to gain and very little to lose. Variety is the spice of life.

Understandable Language

We should not allow language to become a stumbling block in mathematics. Teach only the symbols that are essential and ask for generalizations only after the learner has many experiences with specific examples.

Allow all pupils to express ideas in their own words and not merely the words of mathematicians. Use game strategy to develop the skills of problem solving. Try to make drill and practice fun by varying the activities.

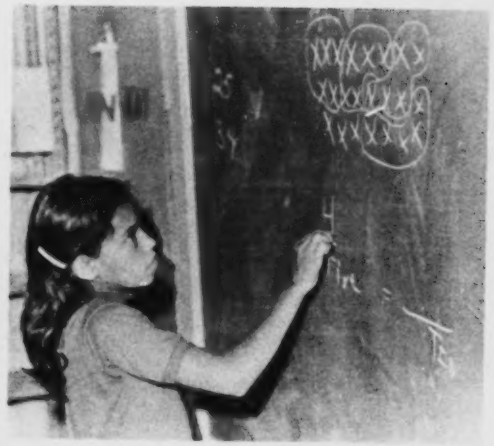
Positive Pupil Attitude

Luther Burbank once said, "Every weed is a potential flower." We need to learn to treat each student as if he is gifted. Praise each step of progress for the road ahead is made up of little steps. The attitude of the pupil is far more important than the amount of mathematics he knows.

All children want to learn and our job is to find some way to help them. If you know mathematics, you can create ways that will reach all the pupils. If children do not learn, it is only because the teacher does not know another method to present.

Continuous Teacher Growth

Our job as teachers, and as educators, is to continue to grow and to learn so that we can teach others. We can *teach* if we vary the content, the expectations, and the methods of presentation. Children call us *teachers* – there is no higher honor. We must earn the name and continue to deserve it!



Tips on Teaching Math

Articles by Dr. Lola May appear regularly in the *Grade Teacher*. Selected quotations which might provide insight to teachers of migrant youngsters include the following:

When we teach we must start at the beginning and not in the middle if we want students to understand what they are doing. Our objectives must be clear and our exercises need to be well designed to show all stages of learning. *(November, 1968.)*

We no longer borrow (in subtraction) as you and I were taught to do way back when. We rename. The technique is hard to teach and tough to learn . . . but well worth the effort.

Renaming is simply a method for thinking of the place value of digits as numerals. The numeral 324 for example, can be renamed 3 hundred, 2 tens, 4 ones. *(October, 1968.)*

Much has been written in the past ten years about the distinction between *number* and *numeral*. At first in writing (new) mathematics for the elementary grades too much fuss was made over the distinction. *(December, 1968.)*

Learning your multiplication facts is the real foundation of performing the algorithm of multiplication. Once a student learns the basic facts through 10 x 10 and has an understanding of place value, he has the basic tools for performing all multiplication tasks.

Learning the fact seems difficult for some students because they do not see any pattern for memorizing them. We must remember it is very difficult to memorize anything that has little meaning. *(November, 1967.)*

Some children see why patterns occur: when you add two odd numbers, the sum is even, but when you add three odd numbers, the sum is odd. Some child may generalize and say an odd number of odds always produces an odd number in addition and an even number of odds always produces an even number. *(September, 1967.)*

It would be a mistake to say that teachers are not using teaching tools (overhead projectors, tape recorders, teaching machines) in math. They are. What they are not doing for the most part is using these tools creatively.

Take the overhead projector, for example. A teacher will sit down next to it and begin writing as she explains this or that mathematical operation. The children look at the screen and every so often the teacher looks up over her light at the children. The teacher's using the overhead projector to be sure, but as a substitute for the chalkboard, not as an avenue to creative teaching.

Tape recorders are an excellent means of reinforcement, especially when you're dealing with the auditory learner, the child who usually becomes bogged down with a lot of reading.

Complete programmed visual and audio presentations can be provided by a teaching machine. This machine will never replace *you*, of course – but it will make life a lot easier by enabling you to reach those students who just aren't "turned on" by chalkboard and textbook.

The more concrete the materials you bring into class, the more creative your teaching will be. *(February, 1970.)*

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Part of the Picture — Interpreting the Environment

Harry H. Feldman

Classrooms — Incubative Boxes

In the name of progress, teacher training (and teacher retraining) is involved in a wave of experimentation. From non-graded systems to electronic devices, emphasis is on the learner and away from formalized teaching. While many innovations are being tried, most educational literature and research is still directed toward teaching within *incubative boxes* — self-contained classrooms. Through the years the average "box" has received controlled temperature, improved lighting, better ventilation, and other physical modifications — but the artificiality of the four-walled setting has not diminished.

Urban multi-room buildings have been in a process of expansion ever since the demise of the one-room schoolhouse. Space is needed not only for increasing enrollment, but for storing the endless collection of items selected for children to study. Providing natural and realistic learning situations is an accepted educational principle, yet further attempts to squeeze the whole world into the classroom only negates this concept. The challenge is not how many objects should be brought into the "box," but how many experiences can be obtained outside where the world really exists. Paradoxically, *children often go inside the classroom to study the very subjects they pass through on their way to school.*

Outdoor Education — An Approach to Better Learning

Textbooks, at best, convey information the authors have personally experienced or reflect incidents that have influenced their lives. *Children should be given first-hand experiences to explore and to discover life's mysteries for themselves.*

Simply stated, outdoor education is making use of the out-of-doors for learning activities that can best be done outside, then returning to the classroom for those things that can best be accomplished inside. Learning that takes place outside the classroom is neither a substitute for abstract subjects nor a replacement for the printed page. Outdoor education is, however, a means of introducing subject matter directly, a way of involving the child in his environment.

Teacher and Child — Partners in Learning

Outside the classroom a relationship takes place between teacher and child that is conducive to learning. Tensions or pressures associated with classroom decorum disappear. In the unstructured setting of the out-of-doors, both teacher and child are relaxed and informal. Learning can be enjoyable and threaded with adventure. The teacher is no longer a dispenser of information but one who helps the learner direct his own efforts toward personal achievement. Children are encouraged to ask questions, to inquire, and to discover. Outside both the child and teacher are looking in the same direction. They are partners in learning, in comparing observations, in interpreting situations, in solving problems, and in making decisions.

The more the child becomes an active participant, the greater will be his interest. His curiosity dulled by classroom routines will return and his senses will sharpen. All the while, new pathways take shape for solving the more subtle problems of living in harmony with others. Sharing one's findings becomes far more important than competing with one's neighbor. Experiences in a natural environment brings children in purposeful and stimulating contact with their surroundings. They also provide foundations for the social aspects of human relations.

Man — Steward or Destroyer of the Land

In the mirror of society, man is beginning to discern his image. He is seeing himself as a threat to his very existence and to the earth supporting him. In order to recover from man's destructive habits, schools need to involve children in many situations that will foster stewardship of the land. A basic understanding (ecological interpretation) is needed concerning the relationship of all living things to their environment; and, equally important, an understanding is needed concerning the environmental crisis that is making our surroundings incapable of sustaining life (ecological blunders, waste, and pollution by man).

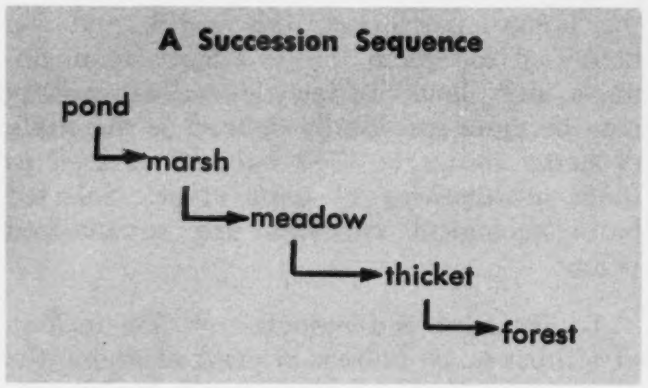
Where outdoor school property is limited, exploration trips into the community offer many valuable lessons. One need not go far to see examples of nature at work, of man's dependence on nature, and of nature's laws being ignored — the latter leading toward ecological chaos. Man's ruthless imprint on the environment has resulted in dead streams, denuded fields, erosion, and pollution. Environmental interpretation should emphasize finding both the natural and unnatural (man-made) conditions. Discovering natural features should lead the learner to seeking their function, purpose, and interrelationships; discovering unnatural features should lead the learner to determining the extent and consequence of damages and to finding steps to restore ecological balance.

Basic Ecological Concepts — Interdependence Plus

With emphasis upon learning *in* and *about* the natural environment, ecological principles form the base and biotic communities form the approach for presenting subject matter. Broadly defined, ecology means "the study of the home — our home, the world, and the homes of all living things." Since man, animals, and plants are interdependent, ecology may be more specifically defined as *the study of living things in their habitats as well as their relationships to each other.* Selected basic ecological concepts are summarized below.

1. **The earth is a home for all.** The making of soil has taken billions of years changing the earth into "homes," making it livable for plants, animals, and man. Life now exists below the top ground layer, on the surface, above and in the air. The earth's "outside covering" in which life is possible is called the *biosphere.* Any stable environment in which living things (plants and animals) and non-living things (sunlight, air, water, and weathered rock) interact and in which materials are used over again (recycled) is called an *ecosystem.* The living organisms in an ecosystem are collectively referred to as a *biotic community.*

2. Succession is an ongoing process. Biotic (living) communities are not static. They are continuously changing in both plant composition and animal characteristics. Meadows do not stay meadows forever. With time, they eventually change to thickets and later to forests. Likewise ponds fill in to form marshes and, as the accumulation of decaying plant matter increases, the marsh becomes drier until meadow plants become dominant. Succession finally leads to a stable community that is able to perpetuate itself under the conditions it creates. This phase is called a *climax* and is named for the dominant (most common) plants in the community. The climax phase, for example, may be a beech-maple forest. The dominant species are usually plants; however, animals sometimes control the vegetation and thereby are dominant.



3. Plants and animals have niches or roles. Within a community every plant and animal has a specific job. The community as a whole is able to function only when all the various roles are occupied. If a vacancy occurs, chaos results and the balance-of-nature is upset. The specific role of an animal or plant is referred to as its *niche*. The concept of niches in a plant-animal community can, in an oversimplified way, be compared to a human community. That is, definite roles exist for

farmers, truckers, grocers, butchers, and garbage collectors. Likewise, various roles (niches) exist in natural communities. These niches all fit together to form a community structure. Some niches of plants and animals in the balance of nature are . . .

— food producers. The basic energy source within a community is the green plant. Green plants are the only organisms on earth capable of capturing the sun's energy and converting it into food. If a plant is green, photosynthesis (food production) occurs within its cells. All green plants — whether they are trees, shrubs, wildflowers, grasses, one-celled green alga, or one-celled plankton — fulfill a niche as food producers.

— planteaters. Herbivores, or animals that eat plants instead of other animals, make up the first food-consumer niche. These animals vary greatly in size from small insects, hundreds of which can live on a single plant stem, to much larger animals such as the deer. They may be specific in their appetite, as certain caterpillars feed only on one species of plant, or more generalized feeders such as rabbits.

— primary meat-eaters. Animals who prey on herbivores, or primary carnivores, receive the sun's energy third-hand. Birds feeding on insects, beetles eating aphids, and foxes dining on rabbits are primary carnivores or predators. They are generally larger and stronger than their prey and more solitary.

— **secondary meat-eaters.** Animals who feed on primary carnivores instead of on herbivores, or secondary carnivores, fill the next niche. Warblers feeding on beetles, hawks preying on snakes, coyotes eating foxes are all receiving the sun's energy fourth-hand. (When food is scarce, secondary meat-eaters may resort to eating some plants and herbivores.)

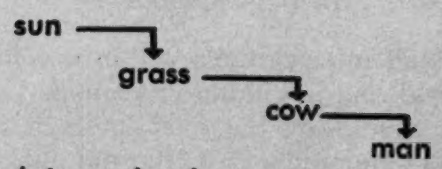
— **parasites.** Parasites derive their energy by living on or within other organisms without killing them. Almost every plant or animal may be parasitized. Parasitism is a natural condition within a biotic community and is not necessarily a disease or an abnormality.

— **scavengers.** Animals who eat dead plants and animals keep the community "clean" and assist in the recycling process. Earthworms are scavengers for they eat dead plant matter in the soil. Termites eat dead branches and wood from fallen trees. Vultures and crows are conspicuous scavengers.

— **decomposers.** This category includes mainly smaller organisms such as bacteria, yeasts, molds, and fungi. Decomposers are essential to the perpetuation of a community for their role is to break down plant and animal tissues and excretia into simpler compounds to be used again by green plants.

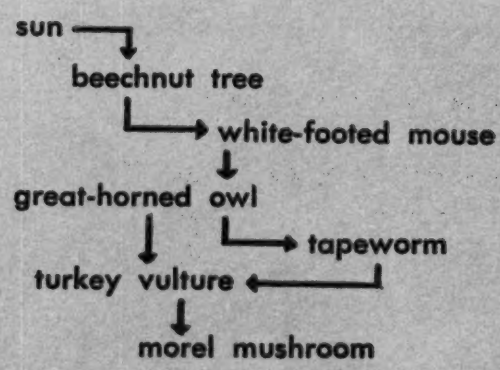
4. Each organism is a link in a chain. From organism to organism, food (energy) is transferred to the next link in a chain. Green plants (food producers) are always considered the first link in the food chain. This concept is a means of describing the food interrelationships of plants and animals living in a community. Each community has different species filling the various links, but the order of the niches are constant. Food chains vary in length, particularly since the consuming of animals by the next larger animal is not always a regular pattern in nature.

A Simple Food Chain



Food is produced, cow eats grass and produces milk, man drinks milk.

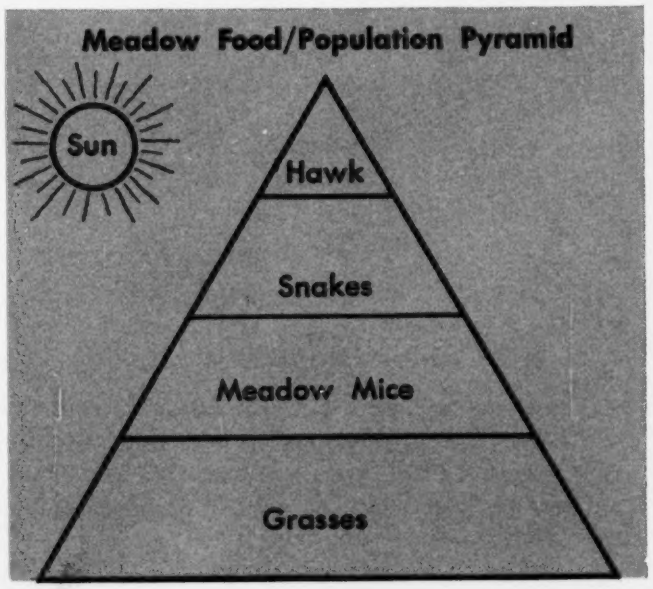
A Forest Community Food Chain



Food is produced, mouse eats fruit of beechnut tree, owl eats mouse, tapeworm lives and eats in owl, vulture eats dead owl and tapeworm, mushroom decomposes dead vulture.

5. Food chains form various patterns or food webs. The food interrelationships within a community are very complex. White-footed mice do not limit their diet to beechnuts. They are primarily herbivores, but will occasionally sample an insect or worm when the opportunity arises. Skunks have an even greater diversity in their food habits. They commonly feed on beechnuts, mice, and mushrooms. Skunks will even eat turkey vulture eggs when they can reach them. Food chains branch in several directions and form various nutritional patterns, or relationships, best described as a *food web* or *web of life*. That is, every predator will consume many kinds of food and every type of plant or animal (food) may be eaten by a variety of animals.

6. Food interrelations within a community form food and population pyramids. Another way of describing the food interrelationships within a community is with a pyramid-shaped structure. This organization emphasizes the numbers of animals within each niche needed to support the next higher niche. It should be noted that substantial energy loss occurs at each layer of the pyramid, and that the rate of energy loss increases toward the top of the pyramid. In the meadow pyramid of life a considerable amount of plants is needed to support the meadow mice and still have adequate supply left over to avoid destroying the food supply. Some mice are eaten by snakes, fewer in number than the mice. The snakes cannot devour all the mice in the process, remaining ones must reproduce for more "snake food." At the top of the pyramid the snakes support one hawk, the final consumer. Food pyramids are also population pyramids since they regulate the number of animals that can survive. If the lower level life is reduced, the higher level life will reduce also since there will be insufficient food, or energy, transmitted upward.



Environmental Education — The Hope for Tomorrow

The strongest point to be made in support of environmental education is that man's existence will depend on how well he learns to care for the environment. No creature on earth has had the power to deliberately destroy the world, . . . except man. Environment is not some place one visits, then leaves; it is our total surroundings.

How to live in a "modern world" has been the problem of every generation, but how to save it from destruction is certainly a problem facing society today. Since school and society go hand in hand, complexities in the world reflect similar conditions in education. The need for dealing with the physical and social environment is vital. Teachers need preparation, schools need areas and facilities, children need opportunities, and society needs to move quickly toward solutions. It is startling to realize that the sixth-grade child of today may be the teacher in the classroom just ten years from now. Will this new teacher be ready to cope with human and natural resources, . . . or will it be too late.

Trips to biotic communities will help the child discover the interrelationships that exist between plants, animals, and their environments. Many possibilities exist on or near a typical school site. Specific suggestions by the author were included in Migrant Children . . . Outdoor Education's Role in Language Development. *As long as the supply lasts, copies of this publication are available by request from the Title I Office, 3201 Alberta Street, Columbus, Ohio 43204.*